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U.S. NATIONAL MUSEUM, WASHINGTON, D.C.

*DR. HARRISON G. DYAR CARL HEINRICH
DR. WM. G. SCHAUS AUGUST BUSCK
DR. L. O. HOWARD FRANCIS H. NOYES

*Deceased

ENTOMOLOGICAL NEWS

VOL. XL. NOVEMBER, 1929 No. 9

North American Institutions Featuring Lepidoptera. VIII. U. S. National Museum, Washington, D. C.

By J. D. GUNDER, Pasadena, California.

(Plate XVI).

Every country has a museum, or group of museums, in its capital city. Among the oldest is the British Museum in London which came into existence in 1753 by act of Parliament and was inspired by the will of Sir Hans Sloane, who left an invaluable collection of books, manuscripts and so-called curiosities. Actually, the first scientific museum on record along modern lines was begun at Oxford, England, in 1667, by Elias Ashmole. Though not under national control, it still survives and is known as the Ashmolean Museum. The beginning of a government collection in America dates from 1826, when James Smithson bequeathed his estate to the United States "to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men." Mr. Smithson's personal effects consisted of several boxes of books and a good mineral collection of about ten thousand small specimens. This formed the nucleus of our nation's first display cabinet. Unfortunnately this collection was destroyed in the Smithsonian fire of 1865. The phrase "National Museum", or the idea of a National Museum, was first suggested in 1840 by Hon. Joel R. Poinsett, of South Carolina, who was Secretary of War under President Van Buren. The words "National Museum of the United States" were painted over the door of the exhibition hall of the Smithsonian Building in 1859 and since then there has been an ever-increasing tendency to submerge the word Smithsonian in favor of the broader name. However, there will always be a Smithsonian Institition Building in

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Washington to perpetuate the original bequest and ideals of the founder.

The new Natural History Building shown in the oval on the accompanying plate was completed in 1912 and is one of several fine structures in Smithsonian Park where all the government museum buildings are located. The Division of Insects, under the Department of Biology, occupies a number of rooms on the third floor and here are assembled all the entomological collections, as well as the offices and laboratories of the many scientists whose work is so well known.

The National collection of insects has from the earliest time been closely associated with the U. S. Bureau of Entomology, which has contributed not only a large part of the specimens during the last forty years, but which, also, has paid the salary of the major part of the working force. The chiefs of the Bureau of Entomology (C. V. Riley and Dr. L. O. Howard) have been the honorary Curators of the insect collections. A portrait of Dr. Howard is among the group[1] shown on plate XVI. The Doctor tells me that for personal study he is partial to parasitic hymenoptera and that next to that he finds great pleasure in adding to his private entomological library, which already consists of six or seven thousand volumes and pamphlets. Since going to Washington in 1878, he has not felt the need of a private insect collection and those which he made as a youth were given to Cornell University. I hope the Doctor will forgive me if I list the degrees which have come to him: B.S., Cornell, 1877; M.S., Cornell, 1883; Ph.D., Georgetown, 1896; M.D., George Washington, 1911; LL.D., Pittsburgh, 1911; Sc.D., Toronto, 1921; LL.D., University of California, 1929. It can be said that L. O. Howard put economic entomology on the map. His books were largely responsible for the anti-house fly campaign all over the world in

[1] Photograph taken Jan. 4, 1929, in the Lepidoptera collection room. This is the last picture in which Dr. Harrison Grey Dyar appeared. He was very shortly to have been made "Expert in Culicidae (mosquitoes), Bureau of Entomology", but death took its toll Jan. 21st. A fine testimonial biography appears in *Science* under date of Feb. 8, 1929, from the pen of Dr. L. O. Howard.

the last twenty years and he will always be remembered as a leader in the international "mosquito campaign". He forced the people and the governments to understand the need of insect control. Dr. Howard was born at Rockford, Illinois, on June 11, 1857, and has three charming daughters.

The small beginnings of the Lepidoptera collections at the National Museum date from Towsend Glover and C. V. Riley. They took more technical form from the early work of John B. Smith and were well on the way when Dr. H. G. Dyar became custodian in 1897 and gave his large collection of North American Lepidoptera to the museum. From then on the collection as a whole acquired importance through the very many types, several thousands, described by Dyar, Schaus, Busck and Heinrich and by the acquisition of numerous large and smaller collections, among the more important of which are:

1897. Harrison G. Dyar collection (gift); North American, arranged according to the Dyar List.

1898. Hoffman collection (purchase); Palearctic Lepidoptera, a very complete, well mounted and well determined European collection.

1903. Wm. Schaus collection (gift); Central and South American Lepidoptera, worked up in subsequent years and constituting the major part of the largest and most important South and Central American collection extant.

1903. U. Nawa collection (gift); Japanese Lepidoptera exhibited at the St. Louis World Fair.

1908. Meyrick collection (gift); Australian Microlepidoptera, authentically named material.

1911-12. Smithsonian Panama Expedition collection; large collection made by Busck and subsequently worked up by Busck and Dyar, yielding many hundreds of new types.

1912. Walsingham collection (gift); Microlepidoptera (c. half types and cotypes) of the *Biologia Centrali-Americana;* also numerous other named micros from Africa and the East.

1920 ?. Idding collection (gift); Lepidoptera, largely exotics in glass mounts and largely used for exhibition purposes.

1924. C. H. Fernald collection (purchase); mainly Micro-

lepidoptera, containing Fish types, Fitch's Pterophorid types and many North American cotypes of Hulst, Packard, Grote and Walsingham, besides Fernald's own Tortricid types.

1925. Dognin collection (purchased by subscription and presented to the Museum); mostly exotics, about 80,000 specimens with over 3000 Dognin types and 300 Thierry-Mieg types.

1925. Schoenborn collection (gift); eastern United States and European material.

1925. Hamfelt collection (purchase); large, well determined and well preserved Palearctic collection.

1928. A. Philpott collection (gift); authentic collection of New Zealand Microlepidoptera, nearly complete.

1929. Brooklyn Museum collection (permanent deposit); a very large series of North American collections, including types of Neumoegen, Hulst and others.

The Lepidoptera collections are all kept in one hundred metal cases of fifty drawers each and two hundred wooden cases of twenty-two drawers each. The drawers average 18 x 18 inches. This makes a total of 9400 drawers containing the butterflies and moths. Perhaps there are well over 500,000 mounted and labeled specimens altogether. The number of types exceed 12,000 according to index record.

When anyone wants to know about foreign moths he asks Dr. William Schaus, for he has worked with and described more exotic Heterocera than any other American. Harry Edwards first interested the Doctor in Lepidoptera. Born in New York City, January 11, 1859, he attended private schools in England and France and won his M.A. at the University of Wisconsin. The degree of D.Sc. was received several years ago from the University of Pittsburgh. Dr. Schaus had a very complete entomological library which was donated to the Smithsonian, but remains under his personal care. He is at present concluding "A Monograph of American Bombycidae" for Seitz's Lepidoptera of the World.

I was very glad to include Mr. Carl Heinrich in the group photograph. Although an associate entomologist with the U. S. Bureau of Entomology, he has been working in conjunction

with the Insect Division of the National Museum since 1913 and has numerous papers upon American moths and their larvae to his credit. Beginning in 1916, he made a number of productive collecting trips through the southwestern United States. Unlike most entomologists, Mr. Heinrich is an all-round student, being well versed and interesting himself in history, literature and philosophy especially. He was born April 7, 1880, in Newark, New York, and was brought up in Omaha, Nebraska.

The gentleman on the extreme right in the picture is Mr. Francis H. Noyes, the well-known entomological artist. He has made upwards of one thousand paintings of Lepidoptera for the Museum. His work is in reality miniature painting of insects. Mr. Noyes says, "I first make an academic drawing of each subject to be figured and then paint it as I would any miniature portrait. I started drawing at the age of fifteen and painting at about eighteen or nineteen under the tutelage of Dr. Wm. H. Holmes, the venerable Director of the U. S. National Museum, than whom, in my humble opinion, there is no superior aquarelle artist. After working in Washington until 1886, I went abroad to study and lived in London and on the Continent for twenty-eight years, returning to America in 1914." To view some of Mr. Noyes' portraits of Lepidoptera is to know to what exceptional success he carries his art. Each figure is an exquisite expression in life-like detail and color.

August Busck first came to the Government in 1895 and he is undoubtedly the American expert on Microlepidoptera. These are the very interesting little fellows of which the common cloths moth is a representative. Mr. Busck has described nearly 1200 new species, the types for the most part being in the National Museum, except for a few in the Wm. Barnes collection at Decatur, Illinois. He has accomplished much revisional work, especially in the Families Gelechiidae, Oecophoridae and Phaloniidae. As a lepidopterist he accompanied the Smithsonian Biological Survey to Panama. Mr. Busck was born Feb. 18, 1870, at Mygdal in the district

of Randers, Denmark, and was raised in Copenhagen where he was graduated from the Royal University. He married Ville Christensen of Hoboken, New Jersey, in July, 1895, and has four children, two boys and two girls.

In the preparation of this article upon the National Museum, I am much indebted to Mr. Busck for considerable patient help. He is a man whom any entomologist would be glad to personally know or correspond with. If you have a few extra micro moths or should incidentally collect some at light, send them on to August Busck, for they may be new and it is worth while to receive any credit of discovery.

A Correction.

In my article upon the Carnegie Museum and its activities, published in the issue of July, 1929, I gave what purported to be a short biographical account submitted to me by my good friend, Dr. W. J. Holland. In preparing the article I did not always closely follow the language of the sketch of his life, which he gave me at my urgent request a year or more ago, and I now discover to my regret that I would have done better to have used exactly the words which he wrote. He did not say, as I represented him as saying: "In 1874 I had learned enough about religion to hold down the pastorship of the Bellefield Presbyterian Church in Pittsburgh. Fortunately, and as a relief from pure clergical work I was almost immediately thereafter made a Trustee of the Pennsylvania College for Women." The original reads: "In the spring of 1874 I was installed as the pastor of the Bellefield Presbyterian Church in Pittsburgh and almost immediately thereafter was made a Trustee of the Pennsylvania College for Women." In the top paragraph of p. 214 I quote Dr. Holland as saying: "About this time I again renewed my interest in natural history and resumed the collection of insects. I felt I needed diversion from the narrowness of the ministerial profession." The original manuscript reads: "About this time I began to feel I needed diversion from more strictly professional duties, and fell back upon the study of nature. I resumed the collection of insects." Dr. Holland insists that I have unfortunately and with no intention of grieving him, quite misrepresented his attitude as to his calling, which he declares is not "narrow" from his point of view, and which he regards as "high and most honorable."—J. D. GUNDER, Pasadena, California.

The Parasites of Wireworms (Coleop.: Elateridae).

By C. A. THOMAS, Pennsylvania State College.

The true wireworms seem to be comparatively free from internal parasites. They are heavily chitinized and live entirely underground, which may have much to do with freedom from attack. That these are not the only factors is indicated by the fact that the "False wireworms" or Tenebrinoid larvae, which are likewise heavily chitinized and subterranean, are attacked by several parasites.

Reference to the literature on wireworms in this country and Europe indicates that the parasites are quite local in their distribution, and in only a few instances could be considered as control factors. Their scarcity is indicated by the following: Conradi and Eagerton, (1914), and Gibson, (1916), found none in their studies of *Horistonotus uhleri* Horn in South Carolina; Graf (1914) found none in ten thousand larvae of *Limonius californicus* Mann. in California; Veitch (1916) found the Sugar-Cane Wireworm, *Simodactylus cinnamoneus* Boisd. free from parasites; Williams and Swezey (1922), in their search for the parasites of the wireworms of Hawaii, found none in the Philippines, Australia, or in the countries bordering the Gulf of Mexico; Escherich (1923) mentioned the scarcity of parasites; Strickland (1927) found no trace of parasites in *Ludius aeripennis* Kby.; and in handling many thousands of wireworms during investigations in Pennsylvania the writer has found only one instance of wireworm parasitism.

Correspondence with investigators on the biology and control of wireworms has elicited the information that although they have handled many thousands of larvae, they have found no parasites.

The most important insect parasites of wireworms belong to the Hymenoptera, chiefly of the families Proctotrupidae and Bethylidae, and to the Diptera. Records of the hymenopterous parasites are as follows:

In England—Bierkander, (1805), found six wireworms in-

*Publication authorized by the Director of the Pennsylvania Agricultural Experiment Station as Technical Paper No. 476.

fested with "Ichneumons", which he did not rear to maturity, and did not name. John Curtis, (1845), noted the rearing of an internal parasite as far as the pupal stage but it did not become adult. He said it probably was a *Microgaster,* and gave a figure of it in the Royal Agricultural Journal, vol. III, plate E, fig. 10. In the same paper (1845), Curtis gave another reference to an "Ichneumon" larva infesting a dead larva of *Elater* (*Agriotes*) *lineatus,* and said the pupa was accidently forced through the wireworm's skin and the adult never emerged. Curtis was possibly wrong in thinking that the pupa projecting through the skin was accidental, as this is a normal habit of the Proctotrupids affecting wireworms. He thought that this parasite was far from uncommon, though he never found many, never reared it to the adult stage, and did not know its name. These same parasites were again referred to on page 159 of his "Farm Insects," (1860), but were doubtfully called *Proctotrupes viator.*

In 1917, Ford noted that *Agriotes obscurus* L. was very free from internal parasites but had been reported by Fryer as being attacked by an undetermined Hymenopteron. Rymer-Roberts, (1919), said that several specimens of a Proctotrupid, *Phaenoserphus* species, probably *P. fuscipes* Hal., were bred in July from a larva of *Athous haemorrhoidalis,* and that Dr. M. Laurie, of the Rothamsted station, found several parasites, probably Proctotrupids, in a larval *Agriotes obscurus.*

Koblova (1922) recorded an undetermined Proctotrupid reared from a larva of *Agriotes lineatus* L. at Orlov, Russia, while Blunck, (1925), stated that in 1922 he obtained one male and nineteen females of the Proctotrupid *Paracodrus apterogynus* Halid. from an *Agriotes sputator* larva in Germany. In 1924, Zolk recorded *P. apterogynus* as parasitizing *Agriotes obscurus* L. in Esthonia. In most instances the parasite pupae protruded from the dead bodies of wireworm larvae that were ready for pupation. In his Nov. 1924 paper, Zolk described and figured this parasite and discussed its biology. In a letter to the writer, Zolk says, "*P. apterogynus* is spreading very rapidly. First found in 1923, in 1924 I found considerably more, and in 1925 the number of infected wireworms was increased

to 25 per cent. Thus this is a very important wireworm parasite, and is the only one found in Esthonia."

Régnier (1928) found the larvae of *Agriotes obscurus* L. to be parasitized by the Proctotrupid, *Phaenoserphus pallipes* Latr. in the neighborhood of Rouen, France, at the end of April. These parasites, a description of which is given, were bred in the laboratory and emerged in series over a period of 15 days, beginning in early May. Régnier stated that Ferrière also found *P. pallipes* as a parasite of undetermined *Agriotes* larvae.

South America—In the "Gaceta Rural", (1914), the Ichneumon, *Bracon dispar.* was said to be an effective parasite of *Agriotes* (*Elater*) *segetis,* which would otherwise be a most injurious pest to cereals in Argentina.

United States—Klippart, in 1860, stated that a small ichneumon fly, *Proctotrupes viator,* was very abundant, laying 20 to 30 eggs in wireworms, producing maggots which destroyed the latter. This note may have been taken by Klippart from Curtis' "Farm Insects".

Hyslop, (1915), found a *Melanotus* larval skin firmly attached to an empty hymenopterous pupal case, which closely resembled a Tiphia cocoon. This was probably a Bethylid cocoon. Hyslop said that J. J. Davis had made an identical observation in Indiana.

Hyslop, (1916) gave a description and account of a larva of the Bethylid, *Pristocera armifera* (Say), which was found in late July, 1915, at Brattleboro, Vermont, attached to the ventral surface of a living *Limonius agonus* (Say) larva. After destroying this wireworm it attacked another and soon killed it, leaving its second host on July 29 and spinning a silken cocoon on the soil surface. The adult parasite emerged on August 30, thirty-three days after the cocoon was spun. Hyslop gave figures of this parasite.

In the late summer of 1924 the writer found an empty light brown silken cocoon in soil at Riverton, N. J. Attached to the outside of this cocoon was the empty skin of a *Melanotus* larva. From the cocoon and from remains of the parasite pupal skin found within the cocoon, A. B. Gahan of the National Museum

identified this as *Pristocera armifera*. This cocoon with its attached wireworm skin is shown in figure 1.

Hayes, (1927), recorded finding, in a corn plot at Manhattan, Kansas, August 19, 1920, a dead larva of *Aeolus dorsalis* Say with an external larval parasite attached. This parasite had its head inserted in the ventral side of the wireworm's abdomen. On August 21 it spun a brown silken cocoon, and the adult emerged in late September. Rohwer identified this adult as *Pristocera armifera*. A similar cocoon was found on the same plots in February, 1921, with a *Melanotus* larval skin attached, but the adult parasite had emerged.

Fig. 1.—*Pristocera armifera* (Say) Cocoon: enlarged x 2. The empty skin of a Melanotus larva is attached to it.

In a recent paper, Bryson, (1929), noted the occurrence of several unnamed parasites among wireworms he had reared at Manhattan, Kansas. J. W. McColloch, of Manhattan, states that the parasite mentioned by Bryson is *Pristocera armifera*. In one collection of *Melanotus* larvae from a pasture near Manhattan in 1928, about 25 per cent. of these wireworms were parasitized by *P. armifera*. This is the only instance of a high percentage of parasitism found at Manhattan.

The above data are all that the writer has found in regard to the hymenopterous parasites of wireworms.

The references to dipterous parasites of wireworms are even more scarce, and consist of the following two items:

S. A. Forbes, (18th Report, 1892, p. 41), says "A single parasitic fly has been bred by us from a wireworm, which because of its condition when found, could be only doubtfully referred to *Melanotus fissilis*." This fly was never determined, and according to a recent letter from Dr. Forbes, cannot now be found in their collection.

The other reference is a paper by C. M. Packard which has just appeared in the Journal of Economic Entomology. In this paper Packard stated that in June, 1919, he reared six specimens of the Dexiid fly, *Ateloglossa cinerea* Coq. from *Melanotus* larvae collected by D. J. Caffrey in his garden at Arlington Heights, Massachusetts. This parasitism did not average over 3 per cent. of the larvae collected. In a lot of *Melanotus* larvae collected in the same garden in the spring of 1921, Van Zwaluwenburg found 20 per cent. parasitism, although apparently no adult parasites were reared. In the field the parasitized wireworms came out onto the soil surface about the time the parasite larvae were ready to emerge. The maggot then issued from the side of the wireworm and formed its puparium just below the soil surface.

Internal Parasites other than Insects.

In Gardeners' Chronicle, London, vol. 3, p. 433, 1843, Bierkander stated that he obtained from a correspondent a *Filaria* worm taken from a wireworm. Curtis referred to this specimen in his "Farm Insects", (1860).

Conradi and Eagerton, (1914), said that a few *Horistonotus uhlerii* Horn larvae were killed presumably by an Annelid parasite observed in the bodies. This was identified as belonging to the family Enchytraeidae by P. S. Welch, who stated, however, that none of the species of this family are known to be true internal parasites, and he wondered whether this might not be a case of accidental parasitism.

Van Zwaluwenburg, (1928), stated "The only record of Nematode parasitism that we know of is given by Dr. F. X. Williams. While in Trinidad he bred an undetermined Mermithid from an Elaterid pupa associated in a rotten log with *Monocrepidius* larvae."

Régnier, (1928), gave a photograph of an adult *Agriotes obscurus* parasitized by an undetermined Nematode.

The foregoing records constitute all that a quite thorough review of the entomological literature has revealed in regard to the internal animal parasites of Elaterid larvae. It is possible, however, that there have been omissions, and the writer will appreciate having such omissions brought to his attention.

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Four New Species of Chiggers (Acarina-Trombidiidae).

By H. E. EWING, Bureau of Entomology, Washington, D. C.

In this paper there are described three new species of *Trombicula* (larval instar) and one new species of *Schöngastia* (larval instar). All four of these species were collected in the Atlantic Coast states. The types are deposited in the United States National Museum.

Key to the Trombicula Larvae Described in this Paper.

1. Palpal claw bifurcate; dorsal plate fully twice as broad as long; 38 dorsal abdominal setae
T. myotis, new species.
Palpal claw trifurcate; dorsal plate about one and a half times as broad as long; not over 32 dorsal abdominal setae .....2.
2. Pseudostigmatic organs pectinate; a transverse line behind each pseudostigmata; dorsal abdominal setae 32
T. bisignata, new species.
Pseudostigmatic organs simple; no transverse line behind each pseudostigmata; dorsal abdominal setae 26-30
T. whartoni, new species.

Trombicula myotis, new species.

Palpi angulate laterally, the outer wall of the second segment being suddenly thickened near the anterior end and produced outwardly into a lateral angle. First palpal seta simple, about as long as the segment on which it is situated; second palpal seta simple and about twice as long as the first; third palpal seta simple and somewhat shorter than the first. Palpal claw divided into two elements, the inner being much the largest and longest. Dorsal plate over twice as broad as long, front margin inwardly curved between each lateral seta and the median seta, posterior margin outwardly angulate behind each pseudostigmata. Pseudostigmata situated almost between the posterior pair of lateral setae of dorsal plate. Pseudostigmatic organs longer than the dorsal plate, flagelliform and pectinate for the distal one-half of their length. Anterior and posterior eyes equal. Dorsal abdominal setae short, thirty-eight in number, and arranged in irregular transverse rows as follows, 2-10-10-6-6-4. Legs moderate, anterior and posterior pairs subequal, second pair considerably shorter.

Length of partly engorged larva, 0.45 mm.; width, 0.25 mm.

Type host.—A bat, *Myotis lucifugus lucifugus. Type locality.*—Mt. Katahdin, MAINE. *Type slide.*—Cat. No. 991, U. S. N. M.

Described from three specimens which were part of a lot taken from the type host at Basin Ponds, Mt. Katahdin, MAINE, September 7, 1928, by Francis Harper and W. J. Hamilton, Jr. The specimens were taken from the tragi and ears. This species is quite distinct from any described *Trombicula* larva in the shape of the dorsal plate, and is the only one to be thus far reported in the Nearctic Zone from a bat host.

Trombicula bisignata, new species.

Palpi with outer margin of large second segment rounded, but not evenly so. First palpal seta pectinate, with many barbs; second palpal seta about as long as first and with only a few barbs; third palpal seta shorter than second and with two or three barbs. Palpal claw trifurcate, the two accessory prongs being small, subequal and situated laterally near the tip. Dorsal plate about one and a half times as broad as long, the front margin being almost straight while the posterior margin forms a broad angle with the apex on the median line. Pseudostigmata medium, situated slightly behind the middle of dorsal plate; immediately behind each in a short transverse line equal in length to the width of the pseudostigma. Each pseudostigmatic organ flagelliform and with about four barbs, its length about equal to the width of the dorsal plate. Front and rear eyes equal. Dorsal abdominal setae thirty-two, not well arranged into transverse rows. First and second pairs of legs subequal and slightly shorter than the third pair.

Length of unengorged larva, 0.31 mm.; width, 0.19 mm.

Type host.—Meadow mouse, *Microtus pennsylvanicus pennsylvanicus. Type locality.*—Mt. Katahdin, MAINE. *Type slides.*—Cat. no. 992, U. S. N. M.

Described from four specimens as follows: one from *Microtus pennsylvanicus pennsylvanicus* taken at Mt. Katahdin, MAINE, August 22, 1928, by W. J. Hamilton, Jr., and three from *Peromyscus maniculatus abietorum* taken at Mt. Desert Island, Maine, August 19, 1928, by W. J. Hamilton, Jr. This species from the extreme northeast part of the United States is nearest the common chigger of Europe, *Trombicula autumnalis* (Shaw) but differs from *autumnalis* in having the transverse lines behind the pseudostigmata and fewer barbs on the pseudostigmatic organs.

Trombicula whartoni, new species.

Palpi rounded laterally. First palpal seta provided with many barbs; second palpal seta provided with several barbs; third palpal seta with two or three barbs. The barbs on all the palpal setae are longer than usual. Palpal claw strongly curved, with two unequal accessory claws below about the middle. Chelicerae stout, curved, but with the tips broken off. Dorsal plate about one and a half times as broad as long; front margin incurved between median line and each lateral corner; hind margin strongly outcurved, more so toward the median line. Pseudostigmata situated about two-thirds the distance from the front margin of dorsal plate to the hind margin, and each a little more than its diameter from the median line. Pseudostigmatic organs longer than the dorsal plate, simple, flagelliform. Anterior and posterior eyes about equal, but the posterior ones without well-developed corneas. Dorsal abdominal setae of the usual size and structure, twenty-six in number not counting four situated on lateral margins. They are arranged in rows as follows, 2-6-6-4-4-2-2. Legs rather short, last pair longest, first pair next, second the shortest. Tarsal spine stout on Tarsus I and II, but almost setiform on tarsus III.

Length of partly engorged larva, 0.60 mm.; width, 0.45 mm.

Type host.—A bird. *Type locality.*—Summerville, SOUTH CAROLINA. *Type slide.*—Cat. No. 999, U. S. N. M.

Described from a single specimen taken from inside of ear of a bird, at type locality, by W. P. Wharton during bird-banding operations. This species is closely related to *T. autumnalis* (Shaw) of Europe, but has simple pseudostigmatic organs and fewer dorsal abdominal setae.

Schöngastia peromysci, new species.

Palpi angulate laterally near the end of large second segment. First papal seta with many barbs arranged along its entire length; second seta similar to first but slightly smaller. Palpal claw long, curved and trifurcate, the two accessory prongs being small, equal and situated on the outside near the tip of claw. Chelicerae stout, strongly curved and sharply pointed. Dorsal plate rather small. Pseudostigmata situated about twice their diameters apart; pseudostigmatic organs subcapitate, with very short pedicels; each being well studded with minute prickles. Dorsal abdominal setae numerous, over forty being present. Legs rather short; first pair equal to third and second pair shorter. Tarsus I enlarged above and distally so as to form sort of a tubercle, which is tipped with a seta.

Length of slightly engorged larva, 0.37 mm.; width, 0.20 mm.

Type host.—White-footed mouse, *Peromyscus leucopus noveboracensis. Type locality.*—Sturbridge, MASSACHUSETTS. *Type slide.*—Cat. No. 993, U. S. N. M.

Described from a single larva which was taken from the type host at Sturbridge, Massachusetts, May 27, 1928, by Francis Harper. This species is most nearly related to *S. sciuricola* Ewing, but in *sciuricola* the first papal seta is only slightly pectinate while the second is simple. In *peromysci* both the first and second palpal setae are heavily pectinate.

Eastern Branch American Association of Economic Entomologists.

A meeting of the Eastern Branch of the American Association of Economic Entomologists will be held on November 21 and 22 at the American Museum of Natural History, 77th Street and Central Park West, New York City. The Hotel McAlpin, Broadway and 34th Street, has been selected as headquarters. Results of research work in the form of papers requiring not more than fifteen minutes for delivery are desired and should be presented in a form suitable for publication, because it is hoped that arrangements will be made for their appearance in the *Journal of Economic Entomology.* The titles of papers, together with a brief statement as to the scope of each (for program purposes) should be submitted to the Secretary by November 8.

The revised Articles of Agreement will be presented for adoption.

As this is the first paper-reading session of the Branch, it is hoped that full advantage will be taken of the opportunities for presenting research work and for discussions.—HARRY B. WEISS, *Secretary,* Room 903, Trenton Trust Bldg., Trenton, New Jersey.

The Brackenridge Clemens Memorial.

The Academy of Natural Sciences of Philadelphia announces that through the generosity of Dr. James B. Clemens there has been established at the Academy a fund to be known as the Brackenridge Clemens Memorial Fund. Dr. Brackenridge Clemens, father of Dr. James B. Clemens, was America's pioneer student of the Microlepidoptera, and his collections and types formed the nucleus of the very important series of that suborder of insects now in the Entomological Department of the Academy.

Born in Wheeling, West Virginia, January 31, 1825, Brackenridge Clemens received his early education at the Virginia Military Institute, and after his graduation there he matriculated at the University of Pennsylvania, Medical Department, graduating with the class of 1848. Much of his life was spent at Easton, Penna., and his first contribution to entomology was published in the year 1859, in the *Proceedings of the Academy of Natural Sciences of Philadelphia.* Between that year and his premature and untimely death in 1867, the elder Dr. Clemens published eighteen papers, eight in the pages of the *Proceedings* and *Journal* of the Academy, and ten in the *Proceedings of the Entomological Society of Philadelphia,* all but one bearing upon the Microlepidoptera. In these contributions he described some hundreds of new species and thirty-one new genera, thus creating the first authoritative literature on the Microlepidoptera to appear in America. In 1903, Dr. August Busck, an outstanding student of the tineid section of the Microlepidoptera, appraised Dr. Clemens' contributions as "a series of systematic and biological articles which yet remain the most important contribution to our knowledge of American Tineina". During the troubled period of civil war days few were able to carry on in the atmosphere of placid thought which scientific work requires. When it is realized that while Dr. Brackenridge Clemens bore his share in the struggle of the day as an officer in the Union Army, and that his foundation of an important field of scientific endeavor was laid on the threshold of and during that great struggle, his example and devotion to his work cannot be other than an inspiration. H. T. Stainton, the eminent British Microlepidopterist, regarded Clemens' work so highly that in 1872 he reprinted in London the papers on Tineina under the title, *The Tineina of North America,* together with his correspondence with Dr. Clemens, which latter gives a delightful picture of the breadth and lucidity of mind of the American worker.

The Brackenridge Clemens Memorial Fund will provide for the care, elaboration and housing of the collections of Microlepidoptera at the Academy, along lines already made possible by Dr. James B. Clemens' assistance; will permit the increase of a recently established special memorial library on the suborder, and will assist in the publication of monographs and similar studies based on the collections covered by the Memorial.

The original collection of Dr. Brackenridge Clemens has been splendidly preserved and is regularly consulted by students of the Microlepidoptera. The entire series of the suborder is now housed in standard glass-top boxes contained in

steel cabinets, while the Memorial Library contains copies of all of Dr. Brackenridge Clemens' publications and the more important works of other authors on the subject covered by the Memorial. The collections of Microlepidoptera now in the custody of the Academy also include the types and paratypic series of a number of authors other than Clemens, and excellent representative collections received from Mr. Frank Haimbach of the Academy's entomological staff, Dr. Annette Braun of Cincinnati, Ohio, and other students of these beautiful and diminutive moths.

A portrait of Dr. Brackenridge Clemens now hangs in the Hall of the Academy, which organization and its kindred entomological society were so closely and intimately associated with his scientific activities. His brilliant and invaluable studies hold an enviable place in entomological science in America, and the Memorial will concretely bring the inspiration of his work to those who follow his path.

Foreign Honorary Members of Two Entomological Societies.

It is interesting to glance at the selections of honorary members that have been made by the two oldest of the national entomological societies, both as to their distribution as to nationality and as to the character of the work that brought these individuals the distinction implied in the election to either of these great old societies.

The Entomological Society of France has, since its foundation in 1832, elected thirty-one foreign honorary members. It has also had the custom of electing French honorary members, and fifty-four of those have been chosen during the nearly one hundred years' existence of the Society.

The Entomological Society of London, on the other hand, does not elect British entomologists as honorary fellows (only foreigners). For many years its rules restricted this list to ten. Later it was increased to twelve. During its entire history it has elected fifty-seven such honorary fellows. As a rule the number permitted by the constitution has been kept complete, and new names have been selected only on the death of a previous occupant of an honorary fellowship.

In the following statement of distribution as to nationalities of such honorary members and fellows, it must be remembered, there are no Frenchmen in the French list and no Englishmen in the English list.

FOREIGN HONORARY MEMBERS OF THE ENTOMOLOGICAL SOCIETY OF FRANCE.

Austria:
Brauer, 1904.
Belgium:
Lacordaire, 1859.
Selys-Longchamps, 1885.
Lameere, 1915.
Denmark:
Schiodte, 1874.
Meinert, 1899.
England:
Kirby, 1832.
Curtis, 1856.
Westwood, 1860.
Darwin, 1874.
Lubbock, 1894.
Sharp, 1907.
Germany:
Humboldt, 1832.
Klug, 1832.
Hungary:
Horvath, 1913.
Italy:
Spinola, 1849.
Berlese, 1905.
Silvestri, 1928.
Russia:
Romanoff, 1899.
Osten-Sacken, 1900.
Spain:
Bolivar, 1913.
Sweden:
Gyllenhal, 1832.
Schönherr, 1843.
Boheman, 1856.
Zetterstedt, 1858.
Thomson, 1882.
Switzerland:
Standfuss, 1905.
Reverdin, 1923.
United States of America:
Leconte, 1879.
Horn, 1885.
Packard, 1894.
Howard, 1905.

FOREIGN HONORARY FELLOWS OF THE ENTOMOLOGICAL SOCIETY OF LONDON.

Austria:
Hammerschmid, 1843(?)
Kollar, 1843 (?)
Wattenwyl, 1893.
Brauer, 1900.
Belgium:
Lacordaire, 1864.
Lameere, 1914.
Denmark:
Schiodte, 1870.
France:
Milne-Edwards, 1843(?)
Lefebvre, 1843 (?)
Dufour, 1861.
Guerin-Meneville, 1866.
Guenée, 1874.
Signoret, 1881.
Fabre, 1901.
Oberthur (C.), 1908.
Marchal, 1918.
Germany:
Gravenhorst, 1843 (?)
Weidemann, 1843 (?)
Klug, 1843 (?)
Zeller, 1850 (?)
Schaum, 1861.
Hagen, 1864.
Siebold, 1870.
Burmeister, 1875.
Mueller (F.), 1884.
Dohrn (C. A.), 1885.
Weissman, 1898.
Ganglbauer, 1906.

Holland:
Haan, 1843 (?)
Snellen (P. T. C.), 1885.
Wasmann, 1911.
Hungary:
Horvath, 1926.
Italy:
Passerini, 1850.
Grassi, 1898.
Berlese, 1915.
Gestro, 1925.
Russia:
Osten-Sacken, 1884.
Reuter (O. M.), 1906.
Tian-Shanski, 1913.
Spain:
Bolivar, 1905.
Sweden:
Schönherr, 1843 (?)
Zetterstedt, 1854.
Boheman, 1866.
Wallengren, 1893.
Thomson, 1895.
Aurivillius, 1900.
Switzerland:
Pictet, 1856.
Saussure, 1872.
Forel, 1894.
Frey-Gessner, 1912.
United States of America:
Leconte, 1864.
Packard, 1884.
Riley, 1889.
Scudder, 1895.
Comstock, 1911.
Howard, 1915.

International Commission on Zoological Nomenclature Opinions 105 to 114.

The undersigned has the honor to invite the attention of the zoological profession to the fact that Opinions 105 to 114 have been published by the Smithsonian Institution.[1] The summaries, in so far as they refer to Entomology, read as follows:

Opinion 106. The Type of *Oestrus* Linn., 1758, is *O. ovis*. The type of *Oestrus* Linn., 1758, is *O. ovis* (Art. 30*g*). Latreille's designation of *Oestrus equi* Fabr. as type of *Oestrus* is not valid (Art. 30*g*). The following five names of dipterous genera are hereby placed in the Official List of Generic Names: *Cephenemyia* (type *trompe*), *Gasterophilus* (type *equi* of Clark, synonym of *intestinalis* de Geer), *Hypoderma* (type *bovis*), *Oedemagena* (type *tarandi*), and *Oestrus* (type *ovis*).

Opinion 113. *Sarcoptes* Latreille, 1802, Type *scabiei*, Placed in Official List.—*Sarcoptes* Latreille dates from 1802 instead of 1804 or 1806 as frequently quoted. It was originally monotypic, containing only *Acarus scabiei*. The 1810 type designation of *Acarus passerinus* is invalid under Article 30*c* and 30*ex*. The acceptance of *Acarus scabiei* as type species of *Acarus* is invalidated by Article 30*g*, according to which *Acarus siro* (syn. *farinae*) is the type of *Acarus*. *Sarcoptes* Latr., 1802, mt. *scabici* is hereby placed in the Official List of Generic Names.—C. W. Stiles (Secretary to the International Commission on Zoological Nomenclature), Washington, D. C.

[1] *Smithsonian Miscellaneous Collections*, v. 73, no. 6, pp. 1-26.

Entomological Literature

COMPILED, WITH THE ASSISTANCE OF "BIOLOGICAL ABSTRACTS," UNDER THE SUPERVISION OF E. T. CRESSON, JR.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species will be recorded.

The numbers **within brackets** [ ] refer to the journals, as numbered in the list of Periodicals and Serials published in the January and June numbers (or which may be secured from the publisher of Entomological News for 10c), in which the paper appeared. The number of, or annual **volume**, and in some cases the part, heft, &c. the latter **within** ( ) follows; then the pagination follows the **colon** :

All continued papers, with few exceptions, are recorded only at their first installments.

*Papers containing new forms or names have an * preceding the author's name.

(S) Papers pertaining exclusively to neotropical species, and not so indicated in the title, have the symbol (S) at the end of the title of the paper.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

☞*Note the change in the method of citing the bibliographical references, as explained above.*

Papers published in the Entomological News are not listed.

GENERAL.—Bezzi, M.—Obituary by B. Parisi. [Mem. Soc. Ent. Italiana] 6: 165-182, ill. **Dallas, E. D.**—Anotaciones referentes a los "tipos" en entomologia y su terminologia. [44] 31: 206-216. **Davis, J. J.**—Insects of Indiana for 1928. [Indiana Acad. Sci.] 38: 299-314, ill. **Fluke, C. L.**—The known predacious and parasitic enemies of the pea aphid in North America. [Agric. Exp. Sta. Univ. Wisconsin] 1929: 47 pp., ill. **Friedrich, A.**—Meine sammelerfahrungen in Brasilien. [14] 43: 138-142. **Handbuch der Zoologie.**—Progoneata: Chilopoda: Insecta by Attems, Handlirsch & Meixner. 4: 673-800, ill. **Heikertinger, F.**—Vom ziele der nomenklatur und seiner erreichung. [Col. Cent.] 3: 161-178. **Hoffman, F.**—Acht monate in den urwäldern von Espirito Santo (Brasilien). [Ent. Jahrbuch] 1929: 53-73. **Hume, H. H.**—The mediterranean fruit fly situation. [Florida State Plant Board] 14: 29-42. **Porter, C. E.**—Algunos insectos de Mancera. [44] 31: 121-122. **Schwarz, E. A.**—Letters of E. A. Schwarz, by J. D. Sherman, Jr. [6] 37: 181-392, ill. **Wileman, A. E.**—Obituary. [9] 62: 215-216. **Wood, A. A.**—A method of preparing wax entomological exhibits. [29] 59: 52-55, ill.

ANATOMY, PHYSIOLOGY, ETC.—Cappe de Baillon, P.—Diplogenèses et formations multiples chez les insectes. [Bull. Biol. France & Belgique] 63: 456-484, ill. **Gadeau de Kerville, H.**—Sur la couleur interférentielle vert d'émeraude brillant du Physonota gigantea (Chrysomelidae).

(S). [25] 1929: 231-232. **Gadeau de Kerville, H.**—Production, chez des insectes desséchés (Coléoptères, Lépidoptères, Hémiptères et Orthoptères), de variations de couleurs par l'action de substances chimiques et de températures élevées. [25] 1929: 214-216. **Jacquet & Bonnamour.**—Note sur les mœurs et l'alimentation de Carpophilus hemipterus [Nitidulidae] et de sa larve. [25] 1929: 223-224. **Macgregor, M. E.**—The significance of the pH in the development of mosquito larvae. [Parasitology] 21: 132-157. **Merker, E.**—Die fluoreszenz im insektenauge, die fluoreszenz des chitins der insekten und seine durchlässigkeit für ultraviolettes licht. [89] 46: 483-574, ill. **Nabours, R. K.**—The genetics of the Tettigidae (grouse locusts). [Bibl. Gen.] 5: 27-104, ill. **Nakahara & Nakahara.**—An observation on the etiology of a certain malformation in the earwig, Anisolabis maritima (Dermaptera). [19] 24: 161-163, ill. **Nolan, W. J.**—Success in the artificial insemination of queen bees at the bee culture laboratory. [12] 22: 544-551. **Piza Junior, S. T.**—Sobre as glandulas salivares dos Blattideos. [Bol. Biol. Brazil] 1928: 6-9, ill. **Pruthi, H. S.**—Homologies of the genitalia of insects. [8] 65: 198-201. **Rosen, H. R.**—The discovery of insect transmission of pathogenic micro-organisms. [68] 70: 355. **Szalay, L.**—Ueber die widerstandsfähigkeit der hydracarinen. [An. Hist. Nat. Mus. Nat. Hungarici] 25: 427-438. **Yung-tai, T.**—Recherches expérimentales sur la métamorphose de "Galleria mellonella". [Bull. Biol. France & Belgique] 63: 350-376.

ARACHNIDA AND MYRIOPODA.—*Banks, N.—Spiders from Panama. [Bull. Mus. Comp. Zool. Harvard Coll.] 69: 53-96, ill. **Chamberlin & Gertsch.**—New spiders from Utah and California. [13] 21: 101-112, ill. **Mello-Leitão.**—Aranhas de Pernambuco, colhidas por D. Bento Pickel. [An. Acad. Brasileira Sci.] 1: 91-112, ill. **Petrunkevitch, A.**—The spider fauna of Panama and its Central American affiliation. [90] 63: 455-469. **Schmitt, C.**—Spinner u. weber bei den tieren. [Kosmos] 26: 306-309, ill.

THE SMALLER ORDER OF INSECTS.—*Banks, N.—Revision of the nearctic Myrmeleonidae. [Bull. Mus. Comp. Zool. Harvard Coll.] 68: 84 pp., ill. **Claude-Joseph.**—Observaciones sobre el Peripatus blainvillei. (S). [44] 31: 223-236, ill. **Jones, D. T.**—A snail-collecting aphis-lion larva. [Marieta Coll. Res. Pub.] 1: 9 pp., ill. **Knoch, V.**—Die wunder des termitenstaates. [Ent. Jahrbuch] 1929: 160-175. ***McDunnough, J.**—Notes on North American Ephemeroptera with descriptions of new species, II. [4]

61: 169-180, ill. **Navas, R. P. L.**—Insectos Neotropicos. Neuropteros. [44] 31: 316-328, ill. **Paton, C. I.**—Migration of dragonflies and uraniid moth in British Guiana. [9] 62: 212-213. **Tulloch, J. B. G.**—Dragonfly migration. [9] 62: 213.

ORTHOPTERA.—Allard, H. A.—Physiological differentiation in overwintering individuals of certain musical Orthoptera. [4] 61: 195-198. ***Karny, H. H.**—Revision der Gryllacriden des Ungarischen National-Museums. (S). [An. Hist. Nat. Mus. Nat. Hungarici] 25: 215-260, ill. **Piza Junior, S. T.**—Contribuição para o conhecimento do apparelho reproductor e da reproducção dos Blattideos. (S). [Bol. Biol. Brazil] 1928: 76-78, ill. **Zeuner, F.**—Beiträge zur systematik und phylogenie der gattung Platycleis und verwandter Decticinen (Tettig.). [Mitt. Zool. Mus. Berlin] 15: 201-235, ill. **Zeuner, F.**—Der einfluss der postglazialen klimaschwankungen auf die verbreitung von Ephippigera vitium (Tettig.). [Mitt. Zool. Mus. Berlin] 15: 87-106.

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novo genero de Coccidea da sub-familia Klossinae (Cariniella carinii). (S). [Bol. Biol. Brazil] 1926: 82-83, ill.

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THE PROBLEMS OF APPLIED ENTOMOLOGY by ROBERT A. WARDLE. XI and 587 pp., 31 figs. McGraw-Hill Book Company, New York. $6.00.—This work, the first part of which largely represents an expansion of the earlier *Principles of Insect Control* by Wardle and Buckle, is one which should be in the hands of every person who wishes to be reliably informed on the present state of knowledge in the now highly diversified field of applied entomology. Not only is the work before us a mine of information as regards fact and theory, but it also possesses the merit of being both fair and critical in its estimate of the achievements of the science and of the problems remaining to be solved. In the opinion of the reviewer, there is much in this book which is reminiscent of Bateson's *Problems of Genetics*, despite the fact that the two works deal with radically different subjects. Both exhibit a refreshing originality of treatment which is most stimulating and suggestive. In both we find that same lack of satisfaction in the finality of the results attained and of the theories promulgated which, however provoking it may be to those who are content with nothing short of certainty, is the very breath of life to the investigator who realizes how tentative our present knowledge is likely to be and who appreciates the fact that innumerable

problems remain to be solved. It is well to have pointed out to us how insecure are many of the conclusions which we are disposed to consider settled on the basis of existing knowledge. In the work at hand, the author, while in no way belittling the noteworthy achievements in applied entomology, shows throughout a most commendable attitude of caution in refraining from expressing in too dogmatic a tone the conclusions which, however much they may be in line with certain classes of facts, may perhaps not be entirely justified when the whole body of evidence is critically reviewed.

Although the work under review is ostensibly intended for those who are engaged in the practical work of insect control, it is by no means lacking in value to others whose main interest lies in fundamental biological phenomena, especially as these are illustrated in insect material. It is obvious that the ultimate basis of insect control is the knowledge which we possess of insect reactions, and, in line with the general recognition of this relation, we find that a very considerable portion of the present book is devoted to a consideration of such purely physiological or ecological problems as would fall under subjects like host adaptability and resistence, biological races, the phase theory, disease, population estimates, climatic adaptability, faunal succession, tropic behavior, parasites and predators, environmental relationships. It is clear, therefore, that the scope of the present work is not narrow, in the sense of being confined to the strictly applied phases of entomology, but that, instead, it contains much which would appeal to the worker in biological science pure and simple.

There can be little doubt that Wardle's work will take high rank as a standard work of reference in the field which it covers. In these days of extreme specialization and often narrowed professional outlook, when the worker in some phase of applied science finds it almost hopeless to keep himself informed of progress in even closely allied branches of his general subject, the need for such a comprehensive summary, as is contained in the present work, of the knowledge accumulated in the diverse subdivisions of applied entomology is clear. In bringing together, within the limits of a single volume, the information compiled from many widely different sources, the author richly deserves the gratitude of his co-workers, not only of those engaged in applied entomology in a strict sense, but also of others who may be more especially interested in the basic biological phenomena underlying insect control. As it is, Wardle's work is one which no entomologist, except perhaps the strictest sort of systematist, can afford to ignore, and it is at least conceivable that a perusal of it might be of

benefit to even a systematist in suggesting, like Bateson's work already mentioned, the broad biological implications of his specialty.

From the point of view of the investigator, one of the most valuable features of the present work is the very extensive bibliography, occupying forty closely printed pages of matter, which forms Part III of the book. The titles are arranged under headings corresponding to the chapters of the text. Naturally, it results from this arrangement that many references are cited more than once, but this in no way detracts from the value of the list which, in the reviewer's judgment, is a model of what a bibliography covering such a wide range of subjects should be.

The text of the book is divided into two parts, Part I, entitled General Problems, treats of the broad principles—physical, chemical, biological,—which underlie the problem of insect control, while Part II, entitled Area Problems, deals more specifically with the particular insect control problems confronting entomologists in the different countries of the globe.

As previously mentioned, Part I represents, to a very considerable extent, an expansion of an earlier work by the same author in joint authorship with Buckle. In the present work, about half of the space devoted to Part I is taken up with subjects which collectively might be classified under the head of natural control, while the remainder could be grouped under that of artificial control. As regards natural agencies of control, we find chapters in this first part on subjects such as host resistence, climatic resistence, tropic behavior, disease, and parasites and predators. In the second half of Part I, pertaining to artificial methods of control, we have chapters on the theory of insecticides, stomach poisons, contact insecticides, fumigants and combination insecticides, and cultural influences.

Part II represents a new departure. It is quite different in general plan from Part I, and, as the author intimates in the preface, might well have formed the basis for a separate book. In the words of the author, this part "attempts to present to the entomologists of any one country some conception of the problems which face his confrères in other countries." In accordance with this plan, the treatment in Part II is geographic throughout, with the notable exception of the last two chapers, treating respectively the subjects of locality disinfection and locality protection. In the opinion of the reviewer, these latter chapters seem out of place in a section otherwise strictly geographic in arrangement, and would more appropriately have come at the end of Part I, in connection with the general consideration of artificial agencies of control.

Owing to the limited amount of space available, scarcely more than a summary is given in Part II of the more important problems in insect control which are met with in the different countries of the globe. This is explicitly recognized by the author, who states that anything like an adequate treatment of this phase of his subject would require a separate book, and he frankly expresses the hope that his outline will serve to stimulate the production of such a text. So far as chapter subdivision in this part is concerned, it is based, with the exception of the two chapters previously mentioned, upon what may appropriately be termed the insect control provinces of the earth. By this is meant that the author groups together those countries or regions in which closely similar insect control problems claim major attention. In some instances these provinces coincide with definitely delimited geographic areas, as, for example, North America, Southeastern Asia, the Euro-Asiatic Plain, the Mediterranean Area, but in other instances he associates regions often widely separated geographically. Thus, we find one chapter with the title, West Africa and Central America, while another treats of South America, South Africa, Central and East Africa.

In selecting matters for special comment or criticism in a work covering as much ground as this, one is as much embarrassed by the wealth and variety of material from which to choose as he is from the realization that anything approaching a satisfactory attempt in that direction would require the cooperation of a number of specialists, each an authority in one of the special fields of investigation covered by the book. On this account the present reviewer will limit his further remarks to those portions of the work which treat of basic biological problems and will leave to others the task of pointing out errors, defects, or omissions in the sections devoted to the more strictly applied phases of the subject.

In a discussion of Uvarov's Phase Theory on pp. 14-16, the examples chosen to illustrate this theory are all drawn from exotic Orthoptera. An illustration much more familiar to readers on this side of the Atlantic could have been found in the case of the old Rocky Mountain locust, *Melanoplus spretus,* which is almost certainly nothing more than the migratory phase of the common and widely distributed grasshopper, *Melanoplus atlanis.*

In his discussion of the Phase Theory, the author, in this, as in other sections of his book, shows his fairness toward and tolerance of views which may impress one as mutually antagonistic. While apparently strongly disposed to favor the phase theory as promulgated by Uvarov, he also presents the views of Plotnikov, who maintains the specific distinctness of swarm-

ing and non-swarming forms of grasshoppers, but argues that, in periods of abundance, variations in the one form approach and overlap those taking place simultaneously in the other, thereby giving what Plotnikov evidently claims to be a deceptive apearance of blending of the two forms. A view of this sort may seem rather far-fetched, but it is well to have it stated clearly in a work of this kind, as it may serve to impress the reader with the futility of trying to solve questions of this nature on the basis of observation alone. The whole problem of specific distinctness or of intergradation, in the case of forms whose taxonomic status is unsettled, needs to be attacked from the side of experimental breeding.

In enumerating, on pp. 33-34, four general principles upon which estimates of infestation should be based, it seems that none of these quite covers a rule which has impressed itself upon the reviewer in an attempt to estimate the abundance of the Japanese beetle, *Popillia japonica*, in successive years. For instance, a survey of any suitable area within the territory infested by this insect shows that, in each year, a rapid reduction in the number of larvae takes place as spring advances. For this reason, in order to obtain comparable results, it is necessary, in any given area, to make the larval surveys at about the same time each year. Thus, if in one year, a larval survey is conducted in April, it would be necessary to make a similar survey in the same month of the following year, as a survey made later in the season would not yield comparable results. Of course, a rule of this kind would apply only in case estimates of insect infestation are intended to cover a series of years.

In view of the many excellent features and the general critical tone of the book, it may seem rather gratuitous to call attention to a passage in which the author would appear to have inadvertently allowed himself to fall into error, or, at least, to have expressed his meaning in so obscure a form as to render it far from obvious. On page 50, in commenting upon the fact that a given month in one part of an insect's range may not be the ecological equivalent of the same month in another part of its range, the author adds, by way of illustration that "the degree of temperature and the amount of rainfall required to produce a particular value of atmospheric humidity or of soil moisture content would not have the same values in the north as in the south." Evidently the meaning which he intended to convey in this passage, (as is also indicated by his insertion of Koppen's table of rainfall necessary to produce stream flow at different temperatures) is that the amount of rainfall required to produce a particular value of

atmospheric humidity or of soil moisture content would be different in the two sections, the obvious reason being that normally the temperature in the one is different from that in the other.

The absence of dogmatic finality, which the author so consistently maintains throughout, is shown in his comments upon the generally accepted mathematical formulations of the rate of development of insects as influenced more especially by temperature. Thus, on page 63, we read that "the more precise work of later observers . . . has cast some doubt upon the absolute correctness of these assumptions, and the question arises as to whether the thermal constant really is constant for all temperatures within the effective range; whether the velocity curve really is a straight line; whether the point at which it cuts the temperature axis is really the true Threshold of Development, whether, in fact, the curve expressing the effective range is an equilateral hyperbola at all." It is well for physiological entomologists to have their attention called thus to the fact that many an assumption, which they are likely to take as an established fact, may not be wholly free from doubt in the present state of knowledge.

Because of the present claim on popular interest which the institution of drastic quarantine measures against the spread of insect pests has called forth in various sections of this country, it is interesting to note that in the present work the author takes a very pessimistic tone as regards the efficiency of such measures. He seems to think that the chances are strongly against the probability of any form of quarantine inspection preventing, or even materially delaying, the introduction or spread of any of the major insect pests. As an example, he mentions the Mediterranean Fruit-fly (of interest in connection with its recent startling discovery in epidemic form in Florida), which, despite the admittedly high efficiency of the California quarantine system, he is apparently disposed to think, may be already established in that State, and that its appearance there in epidemic form is only a question of time and climate. Truly a gloomy outlook from the point of view of legislative control of insect pests! However, our experience in such attempts at insect control is still limited, and it may well be that in the near future, with a richer measure of experience to serve as a guide, public control measures may yet be evolved to a point where they will yield more satisfactory results. The difficulties are great, and may seem insurmountable, but that does not seem adequate ground for advocating the adoption of a *laissez faire* policy in the face of a threatened insect pest invasion.—HENRY FOX.

EXCHANGES

This column is intended only for wants and exchanges, not for advertisements of goods for sale. Notices not exceeding three lines free to subscribers.

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